SAIC Proposed
Long-Term BDCP Water Operations Analytical Range
(February 5, 2010 Draft)

This table and the following subtable A provide the proposed BDCP long term water operations for evaluation in the BDCP Effects Analysis. The operational criteria identified in this table are the criteria agreed to by the BDCP Steering Committee on January 29, 2010 as documented in the handout titled: "SAIC Consultant Team Recommendations for Long Term Operations (January 29, 2010 draft D) – revised version based on SC input."

1. North Delta Diversion Bypass Flows

Objectives include flows of the functional equivalent thereof to (1) maintain fish screen sweeping velocities, (2) reduce upstream transport from downstream channels, (3) support salmonid and pelagic fish transport to regions of suitable habitat, (4) reduce predation effects downstream, and (5) maintain or improve rearing habitat in the north Delta.

Analytical Range A Operational Criteria[1]	Initial Operational Criteria	Analytical Range B Operational Criteria[1]
Constant Low-Level Pumping (Dec-Jun): Diversions up to 10% of river flow for flows greater than 5,000 cfs. No more than 300 cfs at any one intake.	**Constant Low-Level Pumping (Dec-Jun):** Diversions up to 6% of river flow for flows greater than 5,000 cfs. No more than 300 cfs at any one intake.	**Constant Low-Level Pumping (Dec-Jun):** Diversions up to 2% of river flow for flows greater than 5,000 cfs. No more than 300 cfs at any one intake.
Initial Pulse Protection: No pulse flow protection criteria implemented.	**Initial Pulse Protection:** Low level pumping maintained through the initial pulse period. For the purpose of monitoring, the initiation of the pulse is defined by the following criteria: (1) Wilkins Slough flow changing by more than 45% over a five day period and (2) flow greater than 12,000 cfs. Low-level pumping continues until (1) Wilkins Slough returns to pre-pulse flows (flow on first day of 5-day increase), (2) flows decrease for 5 consecutive days, or (3) flows are greater than 20,000 cfs for 10 consecutive days. After pulse period has ended, operations will return to the bypass flow table (SubTable A). These parameters are for modeling purposes.	**Initial Pulse Protection:** No range. (Same as initial operations)

[1] Analytical ranges represent the operational range limits for which the Effects Analysis will evaluate operational parameters. These analytical ranges are part of the process of identifying adaptive management ranges. It is expected that the eventual adaptive management range limits would fall within these analytical ranges.

	Actual operations will be based on real-time monitoring of fish movement. If the first flush begins before Dec 1, May bypass criteria must be initiated following first flush and the second pulse period will have the same protective operation.	
Post-Pulse Operations: After initial flush(es), go to Level I post-pulse bypass rule (see SubTable A) until **10** total days of bypass flows above 20,000 cfs. Then go to the Level II post-pulse bypass rule until **20** total days of bypass flows above 20,000 cfs. Then go to the Level III post-pulse bypass rule.	**Post-Pulse Operations:** After initial flush(es), go to Level I post-pulse bypass rule (see SubTable A) until **15** total days of bypass flows above 20,000 cfs. Then go to the Level II post-pulse bypass rule until **30** total days of bypass flows above 20,000 cfs. Then go to the Level III post-pulse bypass rule.	**Post-Pulse Operations:** After initial flush(es), go to Level I post-pulse bypass rule (see SubTable A) until **20** total days of bypass flows above 20,000 cfs. Then go to the Level II post-pulse bypass rule until **45** total days of bypass flows above 20,000 cfs. Then go to the Level III post-pulse bypass rule.

2. South Delta Channel Flows

Minimize take at south Delta pumps by reducing incidence and magnitude of reverse flows during critical periods for pelagic species.

Analytical Range A Operational Criteria

OMR Flows

Old and Middle River flows no less than the values below:

Combined Old and Middle River flows no less than values below* (cfs)					
Month	W	AN	BN	D	C
Jan	-6000	-6000	-6000	-6000	-6000
Feb	-6000	-6000	-6000	-6000	-6000
Mar	-6000	-6000	-6000	-6000	-6000
Apr	-6000	-6000	-6000	-6000	-6000
May	-6000	-6000	-6000	-6000	-6000
Jun	-6000	-6000	-6000	-6000	-6000
Jul	N/A	N/A	N/A	N/A	N/A
Aug	N/A	N/A	N/A	N/A	N/A
Sep	N/A	N/A	N/A	N/A	N/A
Oct	N/A	N/A	N/A	N/A	N/A
Nov	N/A	N/A	N/A	N/A	N/A
Dec	-7200	-7200	-7200	-7200	-7200

* Values are monthly average for use in modeling. December 20-31 targets are -6000 cfs and are averaged with an assumed background of -8000 cfs for December 1-19.

Initial Operational Criteria

OMR Flows

- FWS smelt and NMFS BO's model of adaptive restrictions (temperature, turbidity, salinity, smelt presence)

Table below provides a rough representation of the current estimate of "most likely" operation under FWS and NMFS BO's for modeling purposes.

Combined Old and Middle River flows no less than values below* (cfs)					
Month	W	AN	BN	D	C
Jan	-4000	-4000	-4000	-5000	-5000
Feb	-5000	-4000	-4000	-4000	-4000
Mar	-5000	-4000	-4000	-3500	-3000
Apr	-5000	-4000	-4000	-3500	-2000
May	-5000	-4000	-4000	-3500	-2000
Jun	-5000	-5000	-5000	-5000	-2000
Jul	N/A	N/A	N/A	N/A	N/A
Aug	N/A	N/A	N/A	N/A	N/A
Sep	N/A	N/A	N/A	N/A	N/A
Oct	N/A	N/A	N/A	N/A	N/A
Nov	N/A	N/A	N/A	N/A	N/A
Dec	-6800	-6800	-6300	-6300	-6100

* Values are monthly average for use in modeling. December 20-31 targets are -5000 cfs (W, AN), -3500 cfs (BN, D), and -3000 cfs (C), and are averaged with an assumed background of -8000 cfs for December 1-19. Values are reflective of the "most likely" operation under the FWS Delta Smelt Biological Opinion. Values for modeling may be updated based on review by fishery agencies.

Analytical Range B Operational Criteria

OMR Flows

- Old and Middle River flows same as proposed Operations during December, January, and June
- Old and Middle River flows no less than -5,000 cfs between July and November

Initial Operational Criteria	
South Delta Export – San Joaquin Inflow Ratio[2] • Sliding scale for flows above the established OMR to share additional SJR flows between export and environment; export share would increase at higher flows • Time value of benefit; crediting outside of period in which flows are acquired [Note that Conveyance WG/HOTT recommends continuing to evaluate the concept of isolating Old River to address south Delta channel flows.][3]	**South Delta Export – San Joaquin Inflow Ratio** • 50% Feb & Mar • 25% April & May

[2] The effects of potential increased San Joaquin River inflows on BDCP goals and objectives will be evaluated separately from the BDCP Effects Analysis.

[3] The concept of isolating Old River to address south Delta channel flows will be evaluated separately from the BDCP Effects Analysis.

3. Fremont Weir/Yolo Bypass

Considerations include (1) increasing spawning and rearing habitat for splittail and rearing habitat for salmonids for >30 days, (2) providing alternate migration corridor to the mainstem Sacramento River, and (3) increasing effectiveness of habitat and food transport in Cache Slough.

Analytical Range A Operational Criteria	**Initial Operational Criteria**
	Sacramento Weir - No change in operations; improve upstream fish passage facilities
	Lisbon Weir - No change in operations; improve upstream fish passage facilities
Fremont Weir – Improve fish passage at existing weir elevation; construct opening and operable gates at elevation 17.5 feet with fish passage facilities	Fremont Weir – Improve fish passage at existing weir elevation; construct opening and operable gates at elevation 17.5 feet with fish passage facilities; construct opening and operable gates at a smaller opening with fish passage enhancement at elevation 11.5 feet
Fremont Weir Gate Operations -	
December 1-March 30 open the 17.5 foot elevation gates when Sacramento River flow at Freeport is greater than 25,000 cfs (provides local and regional flood control benefit and coincides with pulse flows and juvenile salmonid migration cues) to provide Yolo Bypass inundation of 3,000 to 6,000 cfs depending on river stage. Operating the gates to allow Yolo Bypass inundation when Sacramento River flow is greater than 25,000 cfs will reduce impacts to water supply associated with Hood bypass flow constraints. Potential impacts to water supply would be avoided or minimized through an operations plan.	December 1-March 30 (extend to May 15, depending on hydrologic conditions and measures to minimize land use and ecological conflicts) open the 17.5 foot and 11.5 foot elevation gates when Sacramento River flow at Freeport is greater than 25,000 cfs (provides local and regional flood control benefit and coincides with pulse flows and juvenile salmonid migration cues, provides seasonal floodplain inundation for food production, juvenile rearing, and spawning) to provide Yolo Bypass inundation of 3,000 to 6,000 cfs depending on river stage. Operating the gates to allow Yolo Bypass inundation when Sacramento River flow is greater than 25,000 cfs will reduce impacts to water supply associated with Hood bypass flow constraints. Potential impacts to water supply would be avoided or minimized through an operations plan.
Close the 17.5 foot elevation gates when Sacramento River flow at Freeport recedes to less than 25,000 cfs	Close the 17.5 foot elevation gates when Sacramento River flow at Freeport recedes to less than 20,000 cfs but keep 11.5 foot elevation gates open to provide

	greater opportunity for fish within the bypass to migrate upstream into the Sacramento River; close 11.5 foot elevation gates when Sacramento River flow at Freeport recedes to less than 15,000 cfs

6. Delta Inflow & Outflow

Considerations include (1) Provide sufficient outflow to maintain desirable salinity regime downstream of Collinsville during the spring, (2) explore range of approaches toward providing additional variability to Delta inflow and outflow.

Analytical Range A	Proposed Operations	Analytical Range B
Delta Outflow: Jul-Jan: Per D-1641 Feb-Jun: Per D-1641*, except no Roe Island triggering * Current relaxation of Collinsville standard to 4,000 cfs in May and June revised to state when the Eight River Index is 10.0 or less as established on May 1. ** Proportional Reservoir Release concept will continue to be evaluated to the extent that it provides similar response to outflow, inflow, and upstream storage conditions	**Delta Outflow:** Jul-Jan: Per D-1641 Feb-Jun: Per D-1641 * Proportional Reservoir Release concept will continue to be evaluated to the extent that it provides similar response to outflow, inflow, and upstream storage conditions	**Delta Outflow:** **Summer, Winter, and Fall:** Jul-Aug & Dec-Jan: Per D-1641 Sep-Nov: Fall X2 per FWS Smelt BO **Spring:** Feb-Jun: NGO X2-Eight River Index approach in all years (storage off-ramps in all year types will be refined to avoid upstream coldwater storage impacts on all reservoirs). * Proportional Reservoir Release concept will continue to be evaluated to the extent that it provides similar response to outflow, inflow, and upstream storage conditions ** Continue analysis of NGO watershed unimpaired runoff approach as it relates to PREs and parties outside of BDCP. Carry into "related action" alternative.

4. Delta Cross Channel Gate Operations

Considerations include (1) reduce transport of outmigrating Sacramento River fish into central Delta, (2) maintain flows downstream on Sacramento River, (3) and providing sufficient Sacramento River flow into interior Delta when water quality for M&I and AG may be of concern.

Proposed Operations
Oct-Nov: DCC gate closed if fish are present (assume 15 days per month; may be open longer depending on presence of fish) Dec-Jun: DCC gate closed Jul-Sep: DCC gate open

5. Rio Vista Minimum Instream Flows

Maintain minimum flows for outmigrating salmonids and smelt.

Proposed Operations
Sep-Dec: Per D-1641 Jan-Aug: Minimum of 3,000 cfs

7. Operations for Delta Water Quality and Residence Time

Considerations include (1) maintain a minimum level of pumping from the south Delta during summer to provide limited flushing for general water quality conditions (reduce residence times), (2) for M&I and AG salinity improvements, and (3) to allow operational flexibility during other periods to operate either north or south diversions based on real-time assessments of benefits to fish and water quality.

Proposed Operations
Assumptions for analysis: Jul-Sep: Prefer south delta pumping up to 3,000 cfs before diverting from north Oct-Jun: Prefer north delta pumping (real-time operational flexibility)

8. In-Delta Agricultural and Municipal & Industrial Water Quality Requirements

Existing M&I and AG salinity requirements.

Proposed Operations
Existing D-1641 North and Western Delta AG and MI standards EXCEPT move compliance point from Emmaton to Three Mile Slough juncture. Maintain all water quality requirements contained in the NDWA/ DWR Contract and other DWR contractual obligations.[4]

[4] The results of the water quality modeling from the effects analysis will be used to determine if other actions are needed to address water quality issues that may arise, including water quality in the southern and central Delta for both Agricultural and M&I due to the BDCP Long-term operations.

SubTable A. Post-Pulse Operations for North Delta Diversion Bypass Flows.

Level I Post-Pulse Operations

Based on the objectives stated above, it is recommended to implement the following operating criteria:

- Bypass flows sufficient to prevent upstream tidal transport at two points of control: (1) Sacramento River upstream of Sutter Slough and (2) Sacramento River downstream of Georgiana Slough. These points are used to prevent upstream transport toward the proposed intakes and to prevent upstream transport into Georgiana Slough.

Dec - Apr

If Sacramento River flow is over--	But not over--	The bypass is:
0 cfs	5,000 cfs	100% of the amount over 0 cfs
5,000 cfs	15,000 cfs	Flows remaining after constant low level pumping (see main table)
15,000 cfs	17,000 cfs	15,000 cfs plus 80% of the amount over 15,000
17,000 cfs	20,000 cfs	16,600 cfs plus 60% of the amount over 17,000 cfs
20,000 cfs	no limit	18,400 plus 30% of the amount over 20,000 cfs

May

If Sacramento River flow is over--	But not over--	The bypass is:
0 cfs	5,000 cfs	100% of the amount over 0 cfs
5,000 cfs	15,000 cfs	Flows remaining after constant low level pumping (see separate table)
15,000 cfs	17,000	15,000 cfs plus 70% of the

Level II Post-Pulse Operations

Based on the objectives stated above, it is recommended to implement the following operating criteria:

- Bypass flows sufficient to prevent upstream tidal transport at two points of control: (1) Sacramento River upstream of Sutter Slough and (2) Sacramento River downstream of Georgiana Slough. These points are used to prevent upstream transport toward the proposed intakes and to prevent upstream transport into Georgiana Slough.

Dec - Apr

If Sacramento River flow is over--	But not over--	The bypass is:
0 cfs	5,000 cfs	100% of the amount over 0 cfs
5,000 cfs	11,000 cfs	Flows remaining after constant low level pumping (see main table)
11,000 cfs	15,000 cfs	11,000 cfs plus 60% of the amount over 11,000
15,000 cfs	20,000 cfs	13,400 cfs plus 50% of the amount over 15,000 cfs
20,000 cfs	no limit	15,900 cfs plus 20% of the amount over 20,000 cfs

May

If Sacramento River flow is over--	But not over--	The bypass is:
0 cfs	5,000 cfs	100% of the amount over 0 cfs
5,000 cfs	11,000 cfs	Flows remaining after constant low level pumping (see separate table)
11,000 cfs	15,000	11,000 cfs plus 50% of the

Level III Post-Pulse Operations

Based on the objectives stated above, it is recommended to implement the following operating criteria:

- Bypass flows sufficient to prevent upstream tidal transport at two points of control: (1) Sacramento River upstream of Sutter Slough and (2) Sacramento River downstream of Georgiana Slough. These points are used to prevent upstream transport toward the proposed intakes and to prevent upstream transport into Georgiana Slough.

Dec - Apr

If Sacramento River flow is over--	But not over--	The bypass is:
0 cfs	5,000 cfs	100% of the amount over 0 cfs
5,000 cfs	9,000 cfs	Flows remaining after constant low level pumping (see main table)
9,000 cfs	15,000 cfs	9,000 cfs plus 50% of the amount over 9,000
15,000 cfs	20,000 cfs	12,000 cfs plus 20% of the amount over 15,000 cfs
20,000 cfs	no limit	13,000 cfs plus 0% of the amount over 20,000 cfs

May

If Sacramento River flow is over--	But not over--	The bypass is:
0 cfs	5,000 cfs	100% of the amount over 0 cfs
5,000 cfs	9,000 cfs	Flows remaining after constant low level pumping (see separate table)
9,000 cfs	15,000	9,000 cfs plus 40% of the

	cfs	amount over 15,000
17,000 cfs	20,000 cfs	16,400 cfs plus 50% of the amount over 17,000 cfs
20,000 cfs	no limit	17,900 plus 20% of the amount over 20,000 cfs

Jun

If Sacramento River flow is over--	But not over--	The bypass is:
0 cfs	5,000 cfs	100% of the amount over 0 cfs
5,000 cfs	15,000 cfs	Flows remaining after constant low level pumping (see separate table)
15,000 cfs	17,000 cfs	15,000 cfs plus 60% of the amount over 15,000
17,000 cfs	20,000 cfs	16,200 cfs plus 40% of the amount over 17,000 cfs
20,000 cfs	no limit	17,400 plus 20% of the amount over 20,000 cfs

Jul-Sep: 5,000 cfs
Oct-Nov: 7,000 cfs

	cfs	amount over 11,000
15,000 cfs	20,000 cfs	13,000 cfs plus 35% of the amount over 15,000 cfs
20,000 cfs	no limit	14,750 cfs plus 20% of the amount over 20,000 cfs

Jun

If Sacramento River flow is over--	But not over--	The bypass is:
0 cfs	5,000 cfs	100% of the amount over 0 cfs
5,000 cfs	11,000 cfs	Flows remaining after constant low level pumping (see separate table)
11,000 cfs	15,000 cfs	11,000 cfs plus 40% of the amount over 11,000
15,000 cfs	20,000 cfs	12,600 cfs plus 20% of the amount over 15,000 cfs
20,000 cfs	no limit	13,600 cfs plus 20% of the amount over 20,000 cfs

Jul-Sep: 5,000 cfs
Oct-Nov: 7,000 cfs

	cfs	amount over 9,000
15,000 cfs	20,000 cfs	11,400 cfs plus 20% of the amount over 15,000 cfs
20,000 cfs	no limit	12,400 cfs plus 0% of the amount over 20,000 cfs

Jun

If Sacramento River flow is over--	But not over--	The bypass is:
0 cfs	5,000 cfs	100% of the amount over 0 cfs
5,000 cfs	9,000 cfs	Flows remaining after constant low level pumping (see separate table)
9,000 cfs	15,000 cfs	9,000 cfs plus 30% of the amount over 9,000
15,000 cfs	20,000 cfs	10,800 cfs plus 20% of the amount over 15,000 cfs
20,000 cfs	no limit	11,800 cfs plus 0% of the amount over 20,000 cfs

Jul-Sep: 5,000 cfs
Oct-Nov: 7,000 cfs